

unpatentable over U.S. Patent No. 5,699,440 (Carmeli) in view of U.S. Patent No. 6,052,124 (Stein *et al.*). Of the Claims, Claims 1, 6, 11, 16, 21 and 46 are independent Claims. The rejections are respectfully traversed and reconsideration is requested.

The Applicants' disclosed camera calibration technique requires only a blank textureless surface, for example, a blank piece of paper, and uniform illumination. The camera optical and physical shortcomings are used to extract the camera intrinsic parameters. The image of the blank textureless surface having uniform illumination is digitized. The pixel intensity drop off caused by a vignetting effect are determined from the digitized image. An intrinsic parameter of the camera other than the pixel intensity drop off is computed using the determined pixel intensity drop off. The intrinsic parameter computed using the determined pixel intensity drop off may be the focal length, aspect ratio, principal point or the skew. (*See Applicants' specification Page 5, lines 11-13 as originally filed.*)

Regarding Rejection of Claims 1, 2, 4-7, 9-12, 14-17, 19-22 and 25-45 under 35 U.S.C. §112, first paragraph

The pixel intensity drop off caused by a vignetting effect is measured. (*See Applicants' specification Fig. 3 as originally filed.*) The measured pixel intensity drop off is used to compute intrinsic parameters such as focal length, principal point, aspect ratio and skew which are intrinsic parameters other than pixel intensity drop off. (*See Applicants' specification Fig. 2, Page 5, lines 7-21 and Page 12, lines 6-21 as originally filed.*) Applicants respectfully request reconsideration of the rejections under 35 U.S.C. 112.

Regarding Rejection of Claims 1, 2, 4-7, 9-12, 14-17, 19-22 and 25-46 under 35 U.S.C. §103(a) in view of Carmeli and Stein

The cited prior art Carmeli is directed to a technique for testing the electro-optical performance including illumination uniformity of a test device in an electro-optical system. The electro-optical performance of the electro-optical system representative of illumination uniformity is measured based on the effect of vignetting on an output signal. The illumination uniformity of the test device is determined from the measured illumination uniformity of the system which is equal to the product of illumination uniformity of the test device and pre-

calibrated devices in the system. (See Col 4, lines 52-57; Col. 11, lines 12-16 and Col. 6, lines 56-67.)

The cited prior art Stein is directed to a method for reconstructing elements and features of three-dimensional objects in a scene from a plurality of two-dimensional images of the scene. Stein discusses well-known methods of determining intrinsic parameters related to the camera's internal geometry such as aspect ratio, principal point and focal length through the use of specialized patterns or from more than two views of a scene assuming intrinsic parameters are fixed for all views. (See Col. 2, lines 2-13 and lines 32-59.)

In contrast to the Applicants' claimed method for calibrating a camera by determining pixel intensity drop off from a digitized image of a blank textureless surface and "computing an intrinsic parameter of the camera other than pixel intensity drop off using the determined pixel intensity drop off", the cited prior art Carmeli merely discusses measuring the pixel intensity drop off (illumination uniformity). The pixel intensity drop off measurement is the end result. There is no use of that parameter to compute another intrinsic parameter of the camera such as focal length. Instead, intrinsic parameters such as focal length for a component corresponding to the test device are stored a database prior to measuring the pixel intensity drop off. (See Col. 11, lines 10-16; Col. 7, line 40 - Col. 8 line 64.)

Stein was cited for teachings of intrinsic parameters. Stein merely discusses computing intrinsic parameters of the camera through the use of specialized patterns or from more than two views of a scene. There is no suggestion to combine Carmeli and Stein, and even if combined they fail to teach "computing an intrinsic parameter of the camera other than pixel intensity drop off using the determined pixel intensity drop off" as claimed by the Applicants in Claim 1.

Claims 2, 4-5 are dependent on Claim 1 and thus include this limitation over the prior art. Independent Claim 6 recites a like distinction in terms of a computer program product and thus similarly patentably distinguishes over the prior art. Independent Claim 11 recites a like distinction in terms of a computer system.. Independent Claims 16 and 21 recite a like distinction in terms of an apparatus. Claims dependent on Claims 6, 11, 16 and 21 include this limitation over the prior art. Claim 42 includes like limitations distinguishing the cited art.

Accordingly, the present invention as now claimed is not believed to be anticipated by or made obvious from the cited art or any of the prior art. Removal of the rejections under 35

U.S.C. 103(a) and 35 U.S.C. 112, first paragraph and acceptance of Claims 1, 2, 4-7, 9-12, 14-17, 19-22 and 25-46 is respectively requested.

CONCLUSION

In view of the above remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned at (978) 341-0036.

Respectfully submitted,

HAMILTON, BROOK, SMITH & REYNOLDS, P.C.

By Caroline M. Fleming

Caroline M. Fleming

Registration No. 45,566

Telephone: (978) 341-0036

Facsimile: (978) 341-0136

Concord, MA 01742-9133

Dated: 3/6/03